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ABSTRACT

Secondary school and college students can learn how to shape thought through shaping language by using tagmemic heuristics. To approach writing as a thinking process, students apply three heuristics: one for identifying and stating problems, one for exploring problems, and one for evaluating hypotheses or solutions. Guided by a series of exercises, students first perceive inconsistencies between accepted truths, or between personal beliefs and actual experiences; they then articulate the conflicts and formulate questions arising from the problematic situations. After using checklists to help clarify their language in these questions, the students investigate the problems further, generating information and ideas through use of a tagmemic grid, by brainstorming, or by listing evidence from texts. From this exploration, students formulate possible answers to questions and perform a series of exercises designed to help them establish criteria for evaluating their hypotheses. While having difficulty applying the skills developed during tagmemic exercises to real writing situations, students appear to produce more inventive, thoughtful papers after completing these heuristics. (Exercises to help students formulate problems, checklists and criteria for evaluating problems and hypotheses, and a sample of students' work with "The Scarlet Letter" are included.) (MM)

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# USING PROBLEM-SOLVING TO THINK AND WRITE: TAGMEMICS FOR HIGH SCHOOL STUDENTS

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CS 207 624

In a book titled The Mind's Best Work, D. N. Perkins examines how a creative person thinks -- how invention works. In a chapter on what he calls "today's thinking technology" -- that is, proposed heuristics or procedures for making creative and problem solving activities more effective -- Perkins says, "It's far from clear whether good advice about how to think is any good at all." It's unclear, he says, partly because general heuristics are a very new concept, and there hasn't been much time to test them. Any attempt to evaluate them, he adds, should be made in terms of expectations and goals. "Moderate improvement," he points out, is about all we should expect in education for creative thinking.

It makes sense to talk about educational tools in terms of goals. I want to come back later to Perkins' doubts about the value of general heuristics for teaching thinking, and to discuss tagmemic heuristics in the light of his observations. But first I want to focus on some goals for which we who teach composition might use these heuristics. There are some familiar and specific goals: to liven up stale assignments and dull writing; to evoke and explore felt difficulties that may hinder students' abilities to function in a particular environment. There is, in addition, a broader or more general objective that teachers of writing in both high school and college often hold: the objective of improving students' thinking abilities by improving their ability to use writing as a thinking process. My purpose in this talk is to examine the contribution which the tagmemic discovery procedure can make toward this objective.

Let's look at the objective itself. Where are its roots? We have for some years been interested in and aware of research that relates writing to thinking. We are concerned with the work of Piaget and Vygotsky on the interrelationship among thought, speech and writing. Vygotsky's observations about the shaping of a thought first in vague inner speech and finally in words have helped us to perceive how thinking is a languaging act. His idea that change from very compact

~~expand~~ inner speech to very detailed writing requires us to structure the web of meaning is an important concept. The work of Carl Bereiter has also influenced our goals. Many of us accept the concept that writing plays an epistemic function, making possible a kind of extended and involved thought that is almost impossible without writing. We understand Bereiter's observation that writing can be not merely a product of thought but an integral part of thought. These seminal ideas -- that thinking is accomplished through language, that writing makes complex thought possible, and that we think while we write -- underlie our objective of improving thinking skills by means of teaching a thinking and writing process.

Furthermore, the objective appears to be an idea whose time has come. The NCTE recently called on its members to take responsibility to teach thinking. National news media indicate that high school administrations have taken up the objective of teaching thinking. My personal experience in working with high schools shows that many English teachers have embraced the objective of teaching writing as a thinking process. Last January, the New York Times Education section featured an article on the "new emphasis" on teaching students critical thinking. The article pointed out a pervasive concern with students' need to gain thinking skills. It pointed out the increase in courses across the curriculum that teach creative and critical thinking -- including writing courses.

Since teaching thinking as an integral part of writing is an accepted and important goal for us, where does tagmemic theory fit in? I want to put before you specifically the question of the extent to which tagmemic heuristics can help us teach students how to shape thought through shaping language -- how to structure meaning through language -- how to use writing to encourage complex thought. I don't mean to suggest that I have the answers -- only that I have a small amount of relevant experience to offer as testimony.

I've been learning about how to teach tagmemics by working with high school teachers to develop methods to teach some of it in high schools, and I've used those

same methods myself in teaching freshmen at Carnegie-Mellon, I'd like to share with you some of these methods we developed, in order to share with you two specific points:

1. The idea that tagmemic heuristics can be made quite accessible to students (and by the same methods and at the same time, to their teachers);
2. The information I have gleaned about the extent to which tagmemic heuristics can help us accomplish goals of teaching critical and creative thinking by means of writing.

In order to share the teaching methods with you, I'd like to put them briefly in the context of the tagmemic discovery procedure as a whole. As I understand it from Rhetoric: Discovery and Change, tagmemics aims to provide a problem solving procedure as an approach to rhetoric. It aims "to teach the student to solve and see, and share what he/she has seen. While I by no means overlook the importance of the objective of sharing, i.e. communicating what one has seen, I want to focus here just on the solve and see objective. Tagmemic rhetoric seeks to accomplish this goal of teaching students to solve and see by supplying three heuristics: one for identifying and stating problems; one for exploring problems (the well known grid); and one for evaluating hypotheses or solutions.

In the high school composition course we use the first and third of these heuristics -- identifying and stating problems, and evaluating hypotheses. (In the college course, incidentally, I use all three heuristics.) The method we developed for teaching the two heuristics in high school is twofold. First, we provide series of exercises which do two things: (1) they tap into what students already do and start from there; and (2) they break down and simplify an operation so students can easily understand it. Students do these exercises, then, in order to understand the concept involved and develop a basic control of the skill. Second, we ask the students to use the skill in writing. The first step -- the exercises -- is easy for students. The second step -- the application -- is

generally demanding and challenging, as, indeed, we mean it to be.

In the handout I have provided are examples of the exercises for stating problems and for evaluating hypotheses. The problem statement exercises are in two parts, because problem statements consist of two parts -- stating the problematic situation and stating the unknown or question. Tagmemics teaches us that finding problems involves, first, finding a problematic situation or felt difficulty -- perceiving in your own life and your own mind inconsistencies between two values or beliefs you hold, between what you assume to be true and something that appears to contradict that truth, between the way you expect or want something to be and the way it is. The first skill to be learned, then, is the skill of perceiving such inconsistencies. Stating a problematic situation involves articulating the clash or conflict that makes the situation problematic for you. The key to this articulation is to state openly and precisely the value, belief, assumption, expectation or need which underlies the conflict you feel, and then to state precisely the conflicting element. By this articulation, tagmemics helps students shape thought through shaping language -- to use Vygotsky's phrase.

The exercises which teach students to find and state problematic situations combine perceiving inconsistencies and articulating them. Students are helped to articulate the inconsistency they perceive by creating two statements:

A. A statement of the value, belief, assumption, expectation, or need.

B. A statement of a situation in conflict with that value, belief, assumption, expectation, or need.

The series of exercises moves from skills the students already use to new applications of them. On page one of the handout is part of a series to help students develop a topic for a literature paper. First, they identify a problematic situation that is described in a paragraph, stating it in A and B statements. Then they find a problematic situation -- some inconsistency that bothers them -- in

an assigned reading and state it in A and B statements. In my college course, I use many of these same exercises to help students find and articulate problematic situations in addition to literature to write about -- personal problems, social issues, and problems in a professional area or a discipline.

The second part of a problem statement is the question. The series of exercises to develop ability to state good questions moves from where the students are to newer territory. After evoking their knowledge about questions for inquiry, the exercises establish criteria for good questions, ask students to apply the criteria in evaluating some questions, and then ask them to write good questions that arise out of a problematic situation. Page 2 of the handout lists our criteria for good questions for writing.

Page 3 of the handout contains a checklist for problem statements. From this checklist, you can see how the demands for precision of language and for correspondence between the problematic situation and question force students to structure meaning through language.

The question guides the writer's inquiry. The writer explores the problem, generating information and ideas. The exploration can be guided by the tagmemic grid, by brainstorming, or simply by listing evidence from a text. Exploration leads the writer to come up with insights, discoveries, possible answers to the question -- in a word, solutions. It is the quality of those solutions or hypotheses that counts, finally. Effective thinking requires not just mental exercise but reasonable, verifiable, sharable results -- as I tell my students, come up with something worth shouting about.

The heuristic to evaluate alternative solutions speaks to this goal. My exercises to develop this skill of evaluating alternative hypotheses aim to teach students to generate several reasonable hypotheses and to evaluate those hypotheses in order to decide which are good solutions. The series of exercises first evokes the student's perceptions of criteria for evaluation, then presents a list of criteria which the students use to test alternative solutions to problems they have found. Page 4 of the handout shows criteria

for evaluating solutions of problems where the goal is to understand or know something.

Do all these exercises work? Can they really accomplish the goal of teaching students to handle the heuristics? We have in our files many problem statements discovered by college students whose teachers have introduced these exercises. Also, page 5 of my handout lists some problems and alternative solutions developed by high school students writing about The Scarlet Letter. These descriptions of topics show that the students were able to state problems and to formulate alternative hypotheses. The examples also suggest that students thought in formulating their topics -- even that they thought with some inventiveness. So here's some evidence that the tagmemic heuristics of stating problems and evaluating hypotheses are accessible, can be taught, and do encourage some creative and critical thinking.

Additional evidence that I have includes the writing of the high school students, which controlled evaluation showed to contain more and better substance in a post-test than in a pre-test, and the evidence of my own college students, which in my informal judgment seems more thoughtful, interesting, and provocative than the writing of students I have taught by different methods. It seems clear that writing about complex problems encourages complex thoughts. Other anecdotal evidence I have includes statements by teachers and students attesting that the writing course which uses tagmemics makes students think, teaches them to think more systematically, and provides them with tools for thinking which they use in other courses. This sounds as if it reasonably fits Perkins' criterion of moderate improvement.

We should also ask what kind of evidence there is against the ability of tagmemic rhetoric to serve the goal of teaching writing as a thinking process. I do have some reservations against recommending that everybody start teaching tagmemics. They arise because it is in fact hard. Although students use old skills, they must apply them in ways that are new to them. Most students don't

easily learn to find and state good problems for inquiry. Teachers need to review the strategy frequently. The teacher needs to control carefully the problems students choose to write about so that they are neither too limited nor too complex. Also, students have difficulty moving from the exercises, where they develop a skill, to applying the skill in thinking and writing about a problem, to gathering all their insights into a coherent paper. They need repeated practice. It's not this challenge to the students that bothers me, however. In fact, I like challenging students to rise to their highest capabilities of thought and most students like it, too. It's rather the challenge to the teacher that's the difficulty -- the challenge to understand the theory and to formulate and implement the pedagogy -- to be patient and persevering -- and the challenge to give enough time in a course to allow the heuristics to work.

I'd like finally to put these statements about tagmemics in the context of Perkins' statement about general heuristics, i.e., heuristics which are not discipline-specific. Remember the sentence I quoted: "It's far from clear whether good advice about how to teach thinking is any good at all." Perkins gives several reasons for this uncertain result: (1) Students don't use heuristics as well as they should. They don't use broad management strategies or plans to apply particular heuristics, don't know when to do what on their own. (2) Students (and other people) find problem solving processes tediously complete. Therefore they often don't see the need to do the whole process. Modifying the process to streamline it, Perkins points out, is fine. The trouble is that students don't always know where to streamline -- what to leave out. (3) Good heuristics can't substitute for knowledge in a field, i.e. general heuristics are not as powerful as knowing the specific moves in a field.

My purpose in this paper has been to examine the contribution which the tagmemic discovery procedure can make toward the goal of improving students' thinking abilities by improving their ability to use writing as a thinking process. In summary, my sense is that it has much to offer. Students can learn to use the tagmemic heuristics. My own experience and that of other teachers who have

taught tagmemics attests that students using tagmemics as they write work more systematically and think more persistently and more deeply. The students seem to discover better quality theses. And their papers are more interesting and insightful. But the question of whether a general heuristic such as that presented by tagmemics truly does make a lasting and significant difference is open before us. I sense that most students don't know on their own when to do what. We have no good follow-up information to tell us what students do ultimately carry away and use. It will take time to know whether teaching these kinds of heuristics will have a lasting effect. In the meantime, we need to keep working to improve our teaching methods.

Furthermore, it may be, as Perkins suggests elsewhere in The Mind's Best Work, that creative thinking -- discovery -- depends finally not on special processes but on special purposes or intentions. If that's true, then we need to have as a goal and to strive for students to carry away from our courses the purpose of being inventive and thoughtful. In other words, the potential of tagmemics or any other general heuristics can only be fully realized when we teach and use them for the expressed purpose of being inventive. It's not thinking for its own sake, but thinking for the sake of producing something worthwhile and worth sharing, that counts.

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TEACHING THINKING THROUGH WRITING IN HIGH SCHOOL AND COLLEGE

Exercise 1: Problematic Situations

Directions: Identify the problematic situation in the paragraph below, stating the clashing elements in A and B sentences.

Paragraph:

I'm upset because two of my best friends are arguing about whether or not it's worth going to college. One friend says you can get a better job and earn more money without spending the time and money to go to college. The other friend says that even though you might delay getting a job if you go to college, an education will enable you to have a more satisfying career and a fuller life in the long run. I think that there's a lot of truth on both sides.

Problematic Situation:

A. (I believe you can earn more money without going to college.)
B. (I also believe you might have a more satisfying career by going to college.)

Exercise 2: Problematic Situations

Directions: Look for clashing elements (surprises, contradictions, inconsistencies or unfulfilled needs) in a reading assignment. In the space below, answer one of the following questions about the clashing elements you found.

1. What is out of the ordinary, unusual, puzzling, or curious?
2. What is opposite or mismatched?
3. What surprised me?
4. What does not seem to fit?
5. What is incomplete or unfulfilled?

Explain why the situation above is a problematic situation by completing one or more of the following statements:

1. _____ is not likely to work out because _____.
2. I expected _____ but it turned out differently.
3. It is strange that _____.
4. I expect that people act consistently with their beliefs. These people hold _____ to be valuable, but they _____.
5. _____ can be completed by _____.
6. Other explanations you can make: _____.

State the clashing elements in A and B sentences.

A. _____

B. _____

Exercise 3: Asking Questions About Problematic Situations

Some questions help writers more than others. The following list describes the characteristics of good and bad questions for writing.

1. Good questions are logically connected to the problematic situation; bad questions are irrelevant to the problematic situation.

2. Good questions focus attention on a major aspect of the problematic situation; bad questions concentrate on a minor matter.

3. Good questions open an issue for thinking; bad questions require only a yes/no or a one-word response.

4. Good questions are stated as one question; bad questions raise two or more questions.

5. Good questions are stated in neutral language; bad questions express a preconceived judgment.

6. Good questions can be answered with evidence that readers will accept; bad questions depend on personal opinions or feelings for evidence.

7. Good questions give the writer a broad enough area to explore; bad questions confine the writer's exploration to a very limited area.

8. Good questions focus or give direction to a piece of writing; bad questions fail to give focus or direction to a piece of writing because they are too general.

Below are a problematic situation and a list of bad questions. Decide why each question is a bad one and write the number of the criteria above which applies.

Problematic Situation:

A. I expect people to act according to what they say are their needs.
B. Many teenagers claim that they have to take part-time jobs in order to pay for essentials such as school books or to help out at home. Yet they often spend their money on cars, designer jeans, or records.

1. How much money does the average teenager spend on record albums?

2. How can foolish spending habits of teenagers be corrected?

3. Do teenagers spend too much money on things that aren't essential?

4. What are the problems teenagers have with maney?

5. How many teenagers buy designer jeans?

6. What do teenagers want?

# CHECKLIST FOR STATING GOOD PROBLEMS FOR WRITING

Checklist for problematic situations:

1. Are the A and B statements true?
2. Is there an inconsistency in A and B?
3. Is there a single focus or idea in the A and B statements?
4. Do the A and B statements focus on an important issue?
5. Do the A and B statements provide a problematic situation that can be explored?
6. Are A and B stated as precisely as possible?

Checklist for Questions:

1. Does the question grow out of the inconsistency in the A and B statements?
2. Is the question about a major issue?
3. Is the question one you can reasonably be expected to answer?
4. Is there enough evidence available to discuss the question?
5. Are you interested in writing about the question?
6. Is the question stated as precisely as possible?

Criteria for Evaluating Sclutions to Problems Where the Goal is To Understand

1. The hypothesis is useful -- that is, it answers the question. Yes ___ No ___
2. There is sufficient evidence supporting the hypothesis. Yes ___ No ___
3. The hypothesis is consistent with what I know and believe about the world. Yes ___ No ___
4. The hypothesis can take into account major opposing evidence. Yes ___ No ___
5. The hypothesis accounts for all aspects of the problematic situation. Yes ___ No ___
6. The hypothesis is simple -- not far-fetched, not based on many unproved assumptions. Yes ___ No ___
7. The hypothesis works -- that is, I can confirm it by testing it. Yes ___ No ___
8. The hypothesis is as probable as any other and, in addition, it is original -- not obvious, usual, or off-the-top-of-the head. Yes ___ No ___

## HIGH SCHOOL STUDENTS' PROBLEMS AND HYPOTHESES ON THE SCARLET LETTER

1. A. Since Hawthorne comes from a strict Puritan society, I expected him to treat Hester and Dimmesdale critically for their sins.
   B. Hawthorne does not condemn them for their sins but accepts them.
   ? Why does Hawthorne accept Hester and Dimmesdale's sins?

   Thesis 1: Hawthorne accepts Hester and Dimmesdale's sins to display the love which existed between them.
   Thesis 2: Hawthorne accepts Hester and Dimmesdale's sins to show a greater sin of revenge.

2. A. I expected Pearl to be a great comfort to Hester.
   B. Instead she is a constant reminder of Hester's sin.
   ? Why does Pearl do more to remind her mother of her sin than to comfort her?

   Thesis 1: Pearl does more to remind her mother of her sin than to comfort her for she is preoccupied with it.
   Thesis 2: Pearl's elfish nature caused Hester to find her as a constant reminder of guilt.

3. A. I expected Pearl to resent the scarlet letter that her mother wore, because it reminded her of their alienation from society.
   B. However, Pearl seemed attracted to the letter and identified her mother with it.
   ? Why does Pearl seem to be attracted to the scarlet letter?

   Thesis 1: Pearl seems to be attracted to the letter because it symbolizes their alienation from society.
   Thesis 2: Pearl seems to be attracted to the scarlet letter because it is actually a symbol of herself.

4. A. I expected Hester to stop wearing the scarlet letter after Dimmesdale confessed on the scaffold and she returned to Boston.
   B. She continues to wear it.
   ? Why does Hester continue to wear the scarlet letter after the identity of her partner in sin is revealed?

   Thesis 1: Hester continues to wear the scarlet letter because she feels her sin deserves punishment for life.
   Thesis 2: Hester continues to wear the scarlet letter because it has become a major part of her present identity.

5. A. I expected Dimmesdale to remain silent about his sin when he is about to die.
   B. Instead, he confesses the sin and thus destroys his memory.
   ? Why does Dimmesdale choose to confess his sin before he dies?

   Thesis 1: Dimmesdale is forced by his Puritan beliefs to confess his sin.
   Thesis 2: Dimmesdale is forced to confess his sin because he wishes to deny Chillingsworth his victory.